LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN | ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

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Leiden University

Active feedback and functionality in model tissues

In the development of animals, tissues self-organise starting from a single cell into lay- ers, shapes and patterns. This active mechanical process operates beyond the theoretical framework of reaction-diffusion equations such as Turing patterns. At the same time, combining active driving with careful mechanical design of a system is distinct route to pattern formation and artificial functionality. Here, I will begin by introducing vertex models, a tissue model where the two dimensional cell layer is approximated by a polygonal tilings. I will then how two types of active driving can generate function: First, for polar active materials, a coupling of activity to force, a.k.a. self-alignment, is generic. Governed by the activity-elasticity interactions, it generates either flocking or oscillatory dynamics depending on the boundary conditions of the tissue. Second, mechanochemical stress feedback in cell-cell junctions arises from the catch bond dynamics of the actomyosin cortex. It allows a junction to generate a contractile force that can overcome external pulling and thus allow for an active rear- rangement or T1. In vertex and continuum models, for strong enough feedback this gives rise to convergence-extension flows where the flow is opposite the direction of mechanical polarisation, effectively generating a negative viscosity state.

Wednesday, 11 June 2025, 16:15h, Room A348, Theresienstr. 37/III

Prof. Erwin Frey